What is claimed is:

1   1. A method for determining information about the carrier

2   frequency of a signal transmitted by a possibly moving

3   transmitter, the signal having a code component and a carrier

4   component, the method comprising:

5   a) a step (100) of responding to successive approximately

6   carrier-demodulated received signal fragments (102), and

7   providing a set (104) of correlation results indicating

8   information about the correlation of the approximately carrier-

9   demodulated received signal fragments with a replica of the code

10   component and any remaining carrier component, wherein the set

11   (104) is formed using different possible offsets from a nominal

12   carrier frequency used to approximately carrier-demodulate the

13   received signal fragment, and further wherein each element of

14   the set (104) is provided as a phasor ($c_{p,m}$) having a magnitude

15   and a phase; and

16   b) a step (106) of responding to the set (104) of

17   phasors, selecting the phasor ($c_{p,m}$) having a magnitude

18   distinguishing it from all the other elements ($c_{p,m}$) of the set

19   (104), and determining the phase of the selected phasor.

1   2. A method as in claim 1, wherein the set (104) of correlation

2   results is a matrix of correlation results, and further wherein

3   the matrix of correlation results is spanned by an index (m)

4   indicating an offset from a nominal carrier frequency and also by

5   an index (p) indicating code phase, and still further wherein the

6   selected phasor ($c_{p,m}$) is the phasor having the maximum magnitude

7   of all the elements of the set (104).

1   3. A method as in claim 2, wherein the step (100) of providing

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2   the matrix of correlation results includes a step (11) of

3   performing a coherent integration of each of a series of signal

4   fragments, and a step (12) of performing a non-coherent

5   integration in which the phasor results of the coherent

6   integrations are combined without regard to phase.

1   4. A method as in claim 3, wherein the step (12) of performing

2   the non-coherent integration involves multiplying each element of

3   a matrix of correlation results provided using a coherent

4   integration of a first signal fragment, by the complex conjugate

5   of a corresponding element for an immediately preceding signal

6   fragment.

1   5. A method as in claim 2, wherein in providing the matrix of

2   correlation results as phasor values ($c_{p,m}$) and in determining the

3   phase of the phasor having the maximum magnitude of all the

4   elements of the matrix, only at most two phasor values ($c_{p,m}$) are

5   held in a memory device at any instant of time, and of the two

6   phasor values, only the phasor value ($c_{p,m}$) having the larger

7   magnitude is saved in the memory device before calculating a next

8   phasor value ($c_{p,m}$).

1   6. An apparatus (23) for determining information about the

2   carrier frequency of a signal transmitted by a possibly moving

3   transmitter, the signal having a code component and a carrier

4   component, the apparatus comprising:

5   a) means (300), responsive to approximately carrier-

6   demodulated received signal fragments (302), for providing a set

7   (304) of correlation results indicating information about the

8   correlation of the approximately carrier-demodulated received

9   signal fragments with a replica of the code component and any

10   remaining carrier component, wherein the set (304) is formed

11 using different possible offsets from a nominal carrier

12 frequency used to approximately carrier-demodulate the received

13 signal fragment, and further wherein each element of the set

14 (304) is provided as a phasor ($c_{p,m}$) having a phase and a

15 magnitude; and

16   b)   means (306), responsive to the set (304) of phasors

17 ($c_{p,m}$), for selecting the phasor ($c_{p,m}$) having a magnitude

18 distinguishing it from all the other elements ($c_{p,m}$) of the set

19 (304), and determining the phase of the selected phasor ($c_{p,m}$),

20 and for providing information about the carrier frequency based

21 on the phase of the selected phasor ($c_{p,m}$).

1 7.   An apparatus as in claim 6, wherein the set (304) of

2 correlation results is a matrix of correlation results, and

3 further wherein the matrix of correlation results is spanned by

4 an index (m) indicating an offset from a nominal carrier

5 frequency and also by an index (p) indicating code phase, and

6 still further wherein the selected phasor ($c_{p,m}$) is the phasor

7 having the maximum magnitude of all the elements of the set

8 (304).

1 8.   An apparatus as in claim 7, wherein the means for providing

2 the matrix of correlation results includes means (31), responsive

3 to a series of signal fragments, for performing a coherent

4 integration of each of the series of signal fragments, and also

5 means (32), responsive to the coherent integrations, for

6 providing a non-coherent integration in which the phasor results

7 of the coherent integrations are combined without regard to

8 phase.

1 9.   An apparatus as in claim 8, wherein the means (32) for

2 performing the non-coherent integration multiplies each element

3   of a matrix of correlation results provided using a coherent

4   integration of a first signal fragment, by the complex conjugate

5   of a corresponding element for an immediately preceding signal

6   fragment.

1   10. An apparatus as in claim 7, wherein in providing the matrix

2   of correlation results as phasor values ($c_{p,m}$) and in determining

3   the phase of the phasor having the maximum magnitude of all the

4   elements of the matrix, only at most two phasor values ($c_{p,m}$) are

5   held in a memory device at any instant of time, and of the two

6   phasor values, only the phasor value ($c_{p,m}$) having the larger

7   magnitude is saved in the memory device before calculating a next

8   phasor value ($c_{p,m}$).

1   11. A system, including: a transmitter for transmitting a signal

2   having a code component and a carrier component, and a ranging

3   receiver for receiving the signal and for determining information

4   about the carrier frequency of the signal, the ranging receiver

5   characterized in that it comprises:

6   a) means (300), responsive to approximately carrier-

7   demodulated received signal fragments (302), for providing a set

8   (304) of correlation results indicating information about the

9   correlation of the approximately carrier-demodulated received

10   signal fragments with a replica of the code component and any

11   remaining carrier component, wherein the set (304) is formed

12   using different possible offsets from a nominal carrier

13   frequency used to approximately carrier-demodulate the received

14   signal fragment, and further wherein each element of the set

15   (304) is provided as a phasor ($c_{p,m}$) having a phase and a

16   magnitude; and

17   b) means (306), responsive to the matrix (304) of phasors

18 $(c_{p,m})$, for selecting the phasor $(c_{p,m})$ having a magnitude

19 distinguishing it from all the other elements $(c_{p,m})$ of the set

20 (304), and determining the phase of the selected phasor $(c_{p,m})$,

21 and for providing information about the carrier frequency based

22 on the phase of the selected phasor $(c_{p,m})$.

1 12. The system as in claim 11, further comprising a computing

2 resource external to the ranging receiver, and wherein the

3 apparatus communicates information to the computing facility via

4 a wireless communication system and the computing facility

5 provides at least some of the computation needed either to

6 provide the set of correlation results or to select the phasor

7 $(c_{p,m})$.